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Popular Article

Probiotics and Its Benefits in Human Health

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Abstract

Probiotics are living microorganisms that are present in fermented food and cultured milk. They have various beneficial effects on human health such as lowering blood pressure, anti-hypercholesterolemic effects, prevention of gastrointestinal disease and boosting immunity. Recently, probiotics have received significant attention because of their effectiveness in treatment of various oral and skin diseases. They are becoming significant alternative for antibiotics or anti-inflammatory drugs which has led to the growth of the probiotic market. The production of organic acids, such as lactic acid, acetic acid, propionic acid and sometimes hydrogen peroxide, bacteriocins, and antimicrobial peptides (AMPs) having variable range of action are mainly responsible for antimicrobial activity of probiotics. The use of antibiotics, immunosuppressive therapy and irradiation, amongst other means of treatment, may cause alterations in the composition and have effect on the gut microbial flora. Therefore, the introduction of beneficial bacterial species into the GI tract may be a very attractive option to alter gut microbiota composition and provoke immune modulation in a host.

Keywords: Probiotics, bacteriocins, microbiota, immune modulation.

Introduction

Probiotics are defined as live microorganisms which are when consumed in adequate amounts confer a health benefit on the host. The idea of beneficial bacteria is very old. Previously several texts have mentioned the use of fermented milk containing beneficial bacteria to treat gastroenteritis. However, the era of probiotics started at the beginning of the 20th century with Elie Metchnikoff. He correlated the longevity of Bulgarians with their high consumption of fermented milk. The word probiotic was first used in 1965 by Lilly and Stillwell which means “for life”. An expert panel commissioned by FAO (Food and



Agriculture Organization) and WHO defined probiotic as live micro-organisms, which, when administered in adequate amounts confers a health benefit on the host. *Lactobacillus rhamnosus* GG (LGG) was the first probiotic which received most clinical attention to date. The *Lactobacillus* strain which was used traditionally for fermentation by dairy industry was unable to implant the gut. So, *Lactobacillus rhamnosus* strain GG was discovered in 1985, by developing a list of ideal qualities for probiotics.

Other than fermented milk, the intestine is colonized by intestinal microbiota consisting of numerous bacterial species which play an important role in the health of the host. The intestinal microbiota can affect the responses of digestive system and immune system. They protect the host from microbial pathogens by producing bacteriocins, as well as competition for nutrients and attachment to the microbiota. In addition, intestinal bacteria are capable of fermenting nondigestible carbohydrates into short-chain fatty acids (SCFA) and also play a role in the synthesis of vitamins and iron absorption. Numerous *in vitro* or *in vivo* studies have proven the potential of probiotics in prevention of many diseases.

Commonly used micro-organisms as Probiotics

The most frequent bacterial genera used as probiotics are lactic acid bacteria (LAB) such as *Lactobacillus* and *Bifidobacterium*. Probiotic microorganisms are mainly isolated from fermented milk, non-fermented food such as meat, sausage, vegetables and the gut microbiota of human or animals. Some probiotic strains are not lactic acid bacteria, such as *Escherichia coli*, *Propionibacterium* and *Enterococcus*. However, they are less frequently used due to their greater potential risk of adverse effects. Besides bacteria, the yeast, *Saccharomyces boulardii* has also been used for some decades (Table No.1).

Characteristics of Ideal Probiotic bacterial strains

The bacterial strains to be considered as probiotics should have certain characteristics.

1. The strains must reach their site of action, usually the gut. For this, they have to survive the physiological stresses met during ingestion, which include gastric and gut acidity and the presence of biliary salts.
2. They must have proven beneficial effect.
3. They must be non-pathogenic for the host.
4. They must sustain all their characteristics and remain stable throughout the manufacturing process and storage.
5. The strain should have ability to persist in the intestine even if the probiotic strain cannot colonize the gut.
6. Adhesion to the intestinal epithelium to counteract peristalsis's flushing effects.
7. They should be able to interact with the immune cells associated with the gut.



8. They should be of human origin.
9. The strain should have capacity to influence local metabolic activity.

Table 1: Commonly used micro-organisms as Probiotics

<i>Lactobacillus</i> species	<i>Bifidobacterium</i> species	Other lactic acid bacteria	Non lactic acid bacteria
<i>L. acidophilus</i>	<i>B. bifidum</i>	<i>Enterococcus faecalis</i>	<i>Bacillus cereus</i> var.
<i>L. casei</i>	<i>B. infantis</i>	<i>E. faecium</i>	<i>toyoi</i>
<i>L. paracasei</i>	<i>B. lactis</i>	<i>Lactococcus lactis</i>	<i>Escherichia coli</i> strain nissle
<i>L. plantarum</i>	<i>B. longum</i>	<i>Sporolactobacillus inulinus</i>	<i>Propionibacterium freudenreichii</i>
<i>L. reuteri</i>	<i>B. animalis</i>	<i>Streptococcus thermophilus</i>	<i>Saccharomyces cerevisiae</i>
<i>L. rhamnosus</i>	<i>B. breve</i>		<i>S. boulardii</i>
<i>L. johnsonii</i>	<i>B. adolescentis</i>		

Mechanisms of action of Probiotics:

Probiotics have various mechanisms of action. They produce various antimicrobial compounds such as bacteriocin and short chain fatty acid which help in reduction of pathogenic microbes. They modify host intestinal environment by lowering the pH of gut. They compete with pathogenic bacteria for nutritional substrates and adhesion sites on intestinal epithelial cells. They also stimulate the formation of mucosal barrier for pathogenic bacteria and body’s immune response.

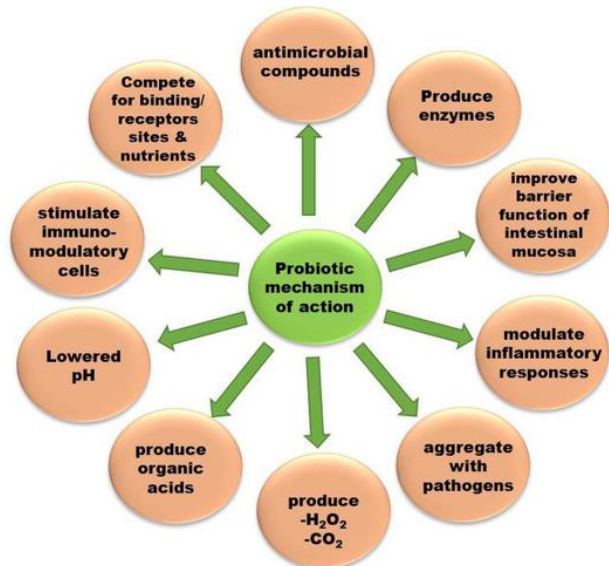


Fig.1: Mechanisms of action of probiotics

Health benefits of Probiotics:

Health benefits of probiotics include improvement in digestion, absorption, and availability of nutrients. Furthermore, probiotics are capable of hydrolyzing compounds that limit the bioavailability of minerals like tannin and phytate. Various studies have shown that *Bifidobacterium spp.* strains can reduce



the side effects of *H. pylori* eradication therapy. Numerous randomized, double blinded and placebo controlled studies have been conducted to explore the beneficial effects of *Lactobacillus reuteri* SD 2222 for treatment of acute diarrhea caused by rota virus in children. Before the advent of antiseptics and antibiotics, fermented milk was used for healing wounds and to fight infections. Recent studies show some success in application of probiotics for treating and preventing surgical infections. Studies shows *L. fermentum* RC-14 was shown to significantly inhibit *S. aureus* infection and bacterial adherence to surgical implants also. Various *in vitro* and *in vivo* studies have suggested the antimicrobial effect of different probiotic agents against several pathogens, such as *Listeria monocytogenes*, *Salmonella* Typhimurium, *E. coli* and *H. pylori*.

Safety of Probiotics

Different strains of probiotics have different safety profiles. Systemic infection has rarely been reported with *Bifidobacterium*, although many cases of sepsis secondary to *Lactobacillus rhamnosus* GG or *Lactobacillus casei* have been reported. The risk and morbidity of sepsis due to probiotic bacteria should be weighed against the potential for sepsis due to more pathological bacteria and the morbidity of the diseases for which probiotic bacteria are being used as therapeutic agents. The reports of sepsis are mainly seen in immunocompromised or infants. In order to establish safety guidelines for probiotic organisms, FAO and WHO recommends that probiotic strains be characterized at a minimum with a series of tests, like antibiotic resistance patterns, metabolic activities, toxin production, hemolytic activities, infectivity in immunocompromised animal models, side effects in humans, and adverse outcome in consumers. FAO/WHO developed Operating Standards in 2002, which gave guidelines for all companies producing probiotic products.

Conclusion

Probiotic therapy is already being used to treat various infectious, inflammatory, neoplastic and allergic conditions. The concept of 'synbiotics' has also been suggested to characterize food and supplements that improve health and are used as functional food ingredients in human diets. However, it is crucial to properly assess these probiotics before incorporating them into regular use. The probiotics should fulfill the standards regarding its quality and reliability. To increase the efficacy of Probiotics, it is important to carefully select the probiotic agent, standardize its dose, and have a good understanding of its effects on human health.

